

Panamá, 19 de agosto del 2011
FIE/N-370/2011

Ingeniera
Marcela Paredes de Vasquez
Rectora
Universidad Tecnológica de Panamá
E. S. D

Estimada Ing. Paredes de Vásquez:

Reciba en primera instancia un cordial saludo y deseos de éxitos en sus delicadas funciones.

Por medio de la presente le hacemos llegar el informe del viaje realizado a Lebanon, New Hamsphire con motivo de la capacitación en el uso del Software Ferroviario Railsim. Adicionalmente se incluye unos anexos a dicho informe.

Para mayor información sírvase comunicarse con los Dr. Rony Caballero (rony.caballero@utp.ac.pa), Dra. Aranzazu de Caballero(aranzazu.berbey@utp.ac.pa) o mi persona (celso.spencer@utp.ac.pa).

Atentamente,

Ing. Celso Spencer
Decano
Facultad de Ingeniería Eléctrica

FACULTAD DE ING. ELECTRICA

UNIVERSIDAD TECNOLOGICA DE PANAMA
RECIBIDO
Recibido por: Yamileth
Hora: 11:36 am
Fecha: 23/8/11
RECTORIA

Adj.: Lo indicado

/Sonia

UNIVERSIDAD TECNOLÓGICA DE PANAMÁ

INFORME DE VIAJE

TIPO Y NOMBRE DE LA ACTIVIDAD	Entrenamiento en el uso del software de simulación ferroviario RAILSIM8
LUGAR Y FECHA (Duración)	El entrenamiento se realizó en las instalaciones de SYSTRA Consulting, Inc de Lebanon New Hampshire, ubicadas en el 3er piso del edificio de Whipple Place (Salt Hill Pub) en 2 West Park Street, Lebanon, E.E.U.U.Lebanon, New Hamsphire (USA).Este se realizó del 18 al 22 de julio de 2011.
OBJETIVOS	Recibir entrenamiento técnico especializado en el uso, modelado, y edición del software de simulación ferroviario RAILSIM 8 de SYSTRA Consulting, Inc. Acrecentar las capacidades científicas y tecnológicas panameñas en materia de ingeniería ferroviaria para realizar futuras formaciones, asesorías, consultorías enel area de simulaciones ferroviarias orientadas al proyecto de la línea 1 del metro de Panamá. Estabicer contactos y relaciones para futuras capacitaciones, convenios y becas dentro del marco de nuestras líneas de interes.Generar las capacidades científicas y tecnológicas panameñas estables y permanentes en materia de ingeniería ferroviaria para realizar futuras formaciones, asesorías, consultorías en materia de simulaciones ferroviarias orientadas al proyecto de la línea 1 del metro de Panamá.
PARTICIPANTE (S)	Dra. Aranzazu Berbey Alvarez, Dr. Rony J. Caballero George e Ing. Celso A. Spencer T.
ASPECTOS RELEVANTES EN EL DESARROLLO DE LA ACTIVIDAD	Este entrenamiento fue exclusivo, por cuanto que los únicos participantes fuimos tres. (Con los requisitos de haber tomado el seminario previo de Tecnología Ferroviaria Orrientado a Metro y manejo del inglés) Por instrucciones de SYSTRA Consulting, Inc, llevamos previamente instalado el software RAILSIM en tres computadoras portátiles. Cabe mencionar que el software de simulación ferroviario RAILSIM no es un programa intuitivo e involucra muchos detalles por lo que se requiere de muchas horas de dedicación prácticas para dominarlo. Los primeros tres días de entrenamiento (del lunes 18 al 20 de julio), fueron impartidos por la facilitadora Carol Steingress, asistida por Julie Taylor, ejecutiva de licenciamiento y mercadeo. Se cubrieron los siguientes temas: **Train Performance Calculator,** **RAILSIM Editor,** **Headway Calculator,** **Safe Braking Calculator, y** **Control Line Generator.** Los siguientes dos días, de entrenamiento (jueves 21 y viernes 22 de julio) el facilitador Jian Guo (Gordon) Yu asistido por Brandon S. Swartley , nos entrenó en el tema de: **DC Load Flow Analysis.** **Facilitadores** **Carol Steingress** es Manager, de Software Testing and Support en SYSTRA Consulting, Inc. para Boston y alrededores en los Estados Unidos. Anteriormente ocupó el puesto de Project Specialist en SYSTRA Consulting, Inc. Es graduada de la University of Rhode Island. **Julie Taylor** tiene el cargo de Software Licensing and Marketing Specialist y es la primera línea de contacto con SYSTRA Consulting, Inc **Jian Guo (Gordon) Yu, PhD., C. Eng :** Con más de 26 años de experiencia en la simulación y análisis de sistemas de tracción de potencia, el Dr. Yu, es miembro de APTA (American Pubilc Transportation Association) y se desempeña en el Foro Técnico de Potencia, Señales y Comunicaciones y el Comité de Investigación en Tecnología. **Brandon Swartley:** Es Assistant Chief Engineer- Electrical Engineering and Power en SYSTRA Consulting, Inc. Es graduado de Drexel University

Universidad Tecnológica de Panamá
Facultad de Ingeniería Eléctrica

RESULTADOS OBTENIDOS (Contacto con futuros expositores, becas, firma de convenio, etc.)	Se establecieron contactos estratégicos con la oficina de SYSTRA Consulting Inc.,en Lebanon New Hampshire, una de la principales empresas consultoras ferroviarias del mundo. Esto es, con el objeto de realizar futuras capacitaciones por parte de la Universidad Tecnológica de Panamá, para prepaar el recurso humano panameñor que operará, controlará y realizará el mantenimiento a la futura linea 1 del Metro de Panamá. Al tercer día, luego de cubrir los temas y ejercicios programados, realizamos preguntas y resolvimos inquietudes en torno al software y a la implementación del sistema de metro en Panamá. Al quinto día, después cubrir los temas y ejercicios programados, tuvimos la oportunidad de configurar para simulación posterior, un prototipo de tren panameño, muy similar al que va a circular próximamente en la primera línea del Metro de Panamá. Se estableció el contacto con excelentes posibles expositores que encajan apropiadamente en actividades futuras
CONCLUSIONES	El Dr. Rony Caballero, la Dra. Aránzazu Berbey Álvarez, y el Ing. Celso Spencer asistieron al entrenamiento en el Software Ferroviario RAILSIM8, donde se tocaron temas como: • Train perfomance calculador • Headway calculador • Control line generador • RAILSIM editor • Safe braking calculador • DC Load Flow Analyzer Se cumplieron los objetivos mas alla de las expectativas, por cuanto que recibimos un entrenamiento de 40 horas personalizado (tres participantes dos instructores) con facilitadores de amplia experiencia y reconocimiento en sus áreas de experticia.
RECOMENDACIONES	Es preciso incluír el entrenamiento en la compra de los software de simulación ferroviarios especializados. Esto permite grandes ahorros en el tiempo de aprendizaje y dominio de estos programas de aplicación y facilita el uso adecuado e interpretación de los resultados que arrojan los mismos. Dada la importancia de estos temas ferroviarios orientados a metro, con visión de país, debemos capacitarnos con la debida antelación para poder entrenar el recurso humano panameño de manera que pueda alcanzar las competencias que se van a requerir para operar, mantener y eventualmente expandir la primera linea del Metro de Panamá.
	Se adjunta anexos de las actividades de capacitación correspondiente del viaje de entrenamiento y del sotfware ferroviario del simulador RAILSIM. Tambien se adjuntan copias de los certificados de los participantes.
ANEXOS	

Dra. Aranzazu Berbey Alvarez PE-8-107
Dr. Rony Caballero 4-205-293
Ing. Celso A. Spencer 8-421-949

Firma y cédula del participante:



Fecha de entrega del informe: 18/08/2011

FACULTAD DE ING. ELECTRICA

Anexo para informe de viaje

Dra. Aranzazu Berbey Álvarez (Investigadora-FIE)
Dr. Rony Caballero George (profesor FIE)
Ing. Celso Spencer – (Decano FIE)

La Dra. Aranzazu Berbey Álvarez, el Dr. Rony Caballero y el Ing. Celso Spencer asistieron al Entrenamiento sobre del Software Ferroviario RAILSIM, donde se tocaron temas como:

- Train perfomance calculador
- Headway calculador
- Control line generador
- Railsim editor
- Safe braking calculador
- DC Load Flor Analyzer

Celebrado desde el 18 al 22 de julio del 2011 en Lebanon, New Hamsphire, USA; donde tuvo una duración de 1 semana.



Figura 12. Ing. Celso Spencer, Dra. Aranzazu Berbey, Dr. Rony Caballero; participando en el Entrenamiento sobre del Software Ferroviario RAILSIM celebrado en Lebanon, New Hamsphire, USA;



Figura 13. Ing. Celso Spencer, Dra. Aranzazu Berbey, Dr. Rony Caballero acompañados del Dr. J. Gordon Yu (Profesor del curso), Ing., Brandon S. Swartley (Asistente del Dr. Yu),



Figura 14. Ing. Celso Spencer, Dra Aranzazu Berbey, Dr Rony Caballero acompañados de la Ing. Julie Taylor (Asistente de Software Railsim-Systra), Ing, Brandon S. Swartley (Asístente del Dr. Yu).



Anexo de insumos cientificos



Figura 1. Software RAILSIM

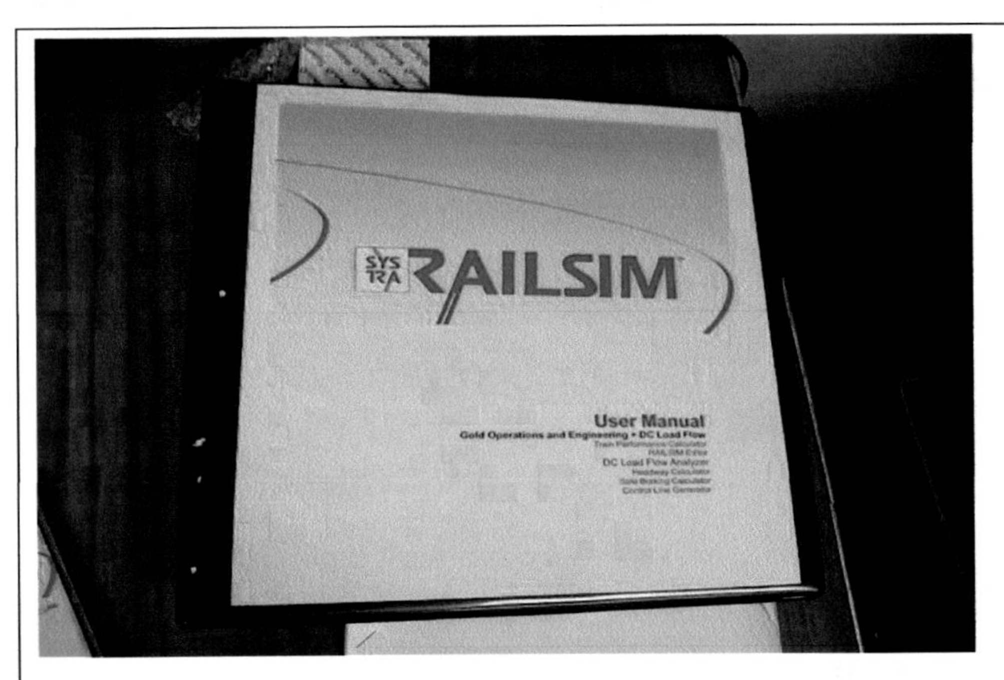


Figura 2. Manual de usuario del software RAILSIM

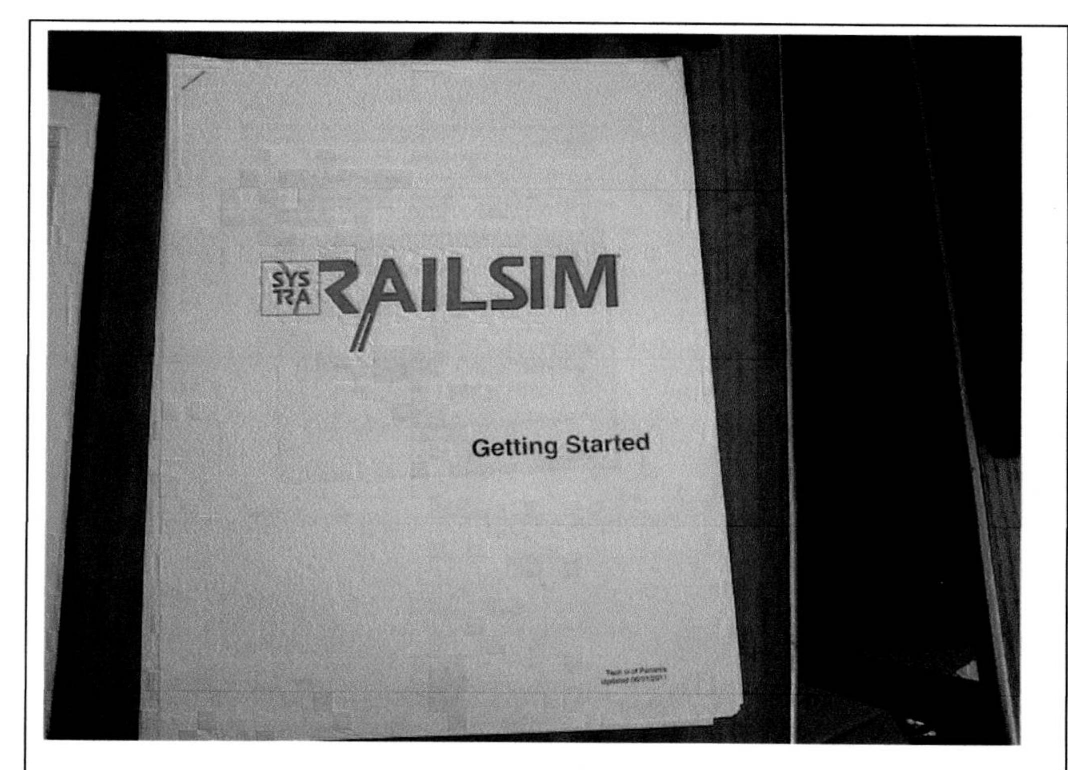


Figura 3. Manual de como empezar a usar el software RAILSIM

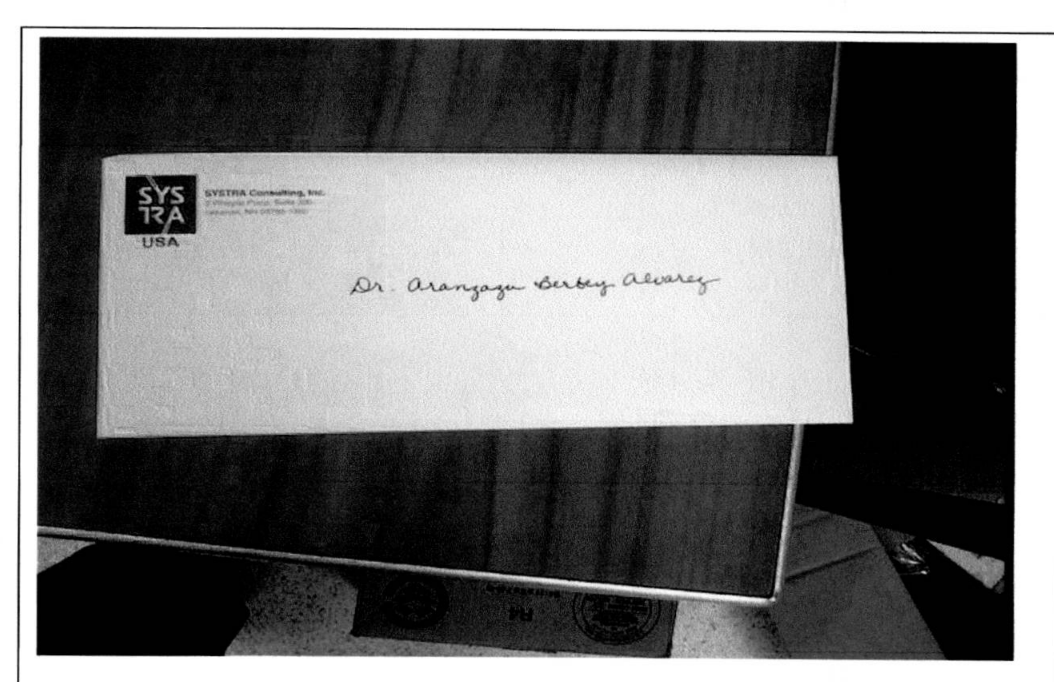


Figura 4. Carta dirigida la Dra. Aránzazu Berbey Alvarez por SYSTRA; compañía la cual fue comprada el software RAILSIM

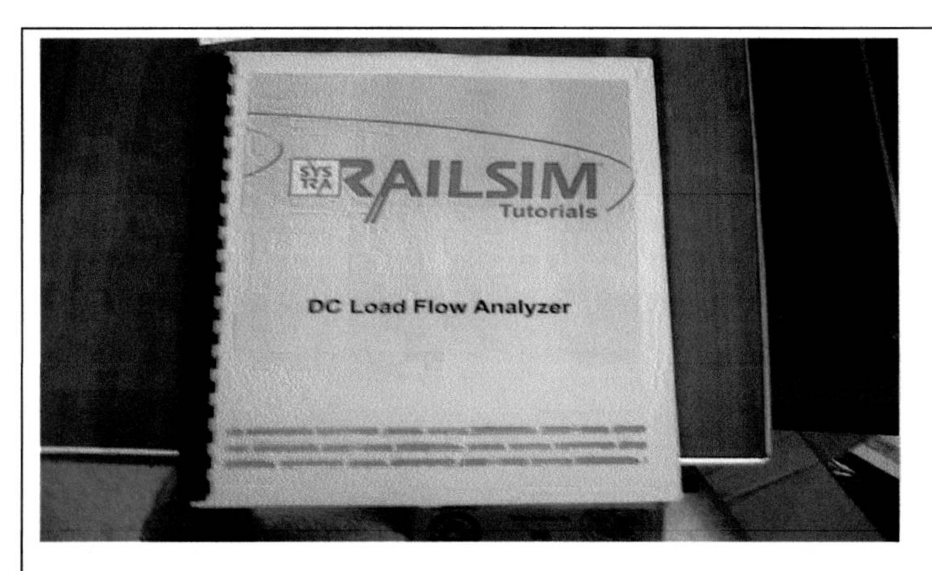


Figura 5. Folleto llamado: DC load flow analyer, encontrado en el kit del software RAILSIM



(A) (B)



(C)

Figura 6. Software RAILSIM; (A) software original del kit RAILSIM; (B) software original actualizado dado a la Dra. Aránzazu Berbey en el Entrenamiento sobre del Software Ferroviario RAILSIM, Celebrado desde el 18 al 22 de julio del 2011 en Lebanon, New Hamsphire, USA; (C) imagen de los 2 CDs juntos

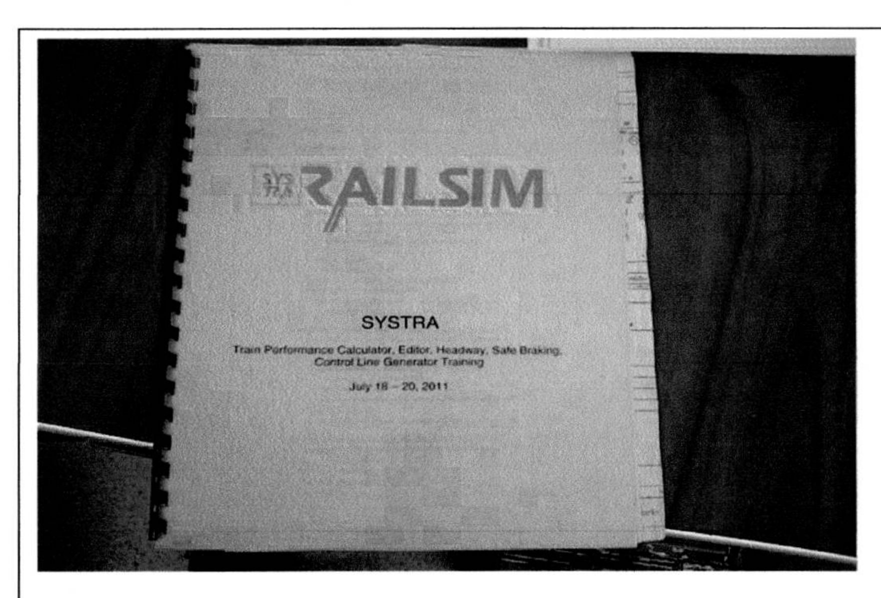


Figura 7. Folleto llamado: Train Performance Calculator, Editor, Headway, Sale Braking, Control Line Generator Training; *encontrado en el* Kit RAILSIM

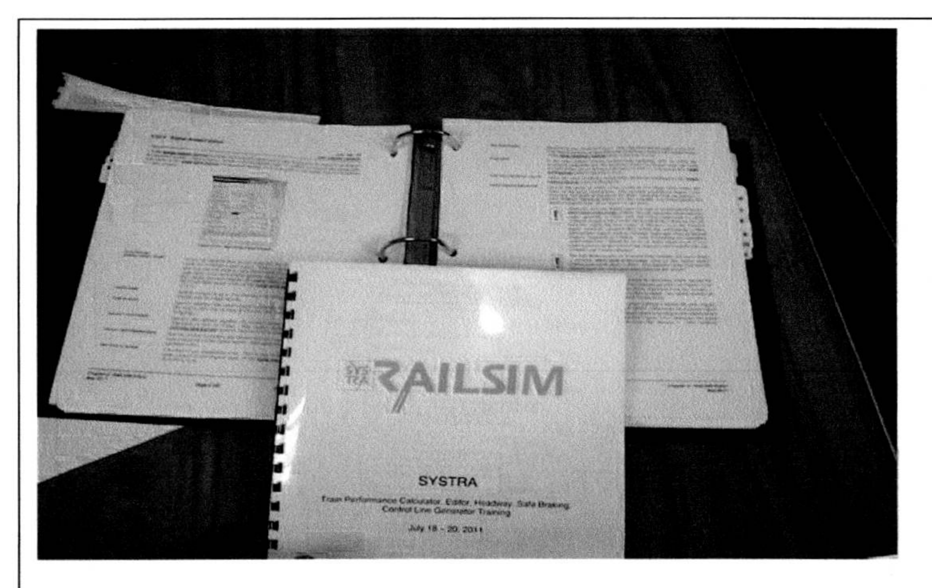


Figura 8. Muestra de los manuales y folletos abiertos



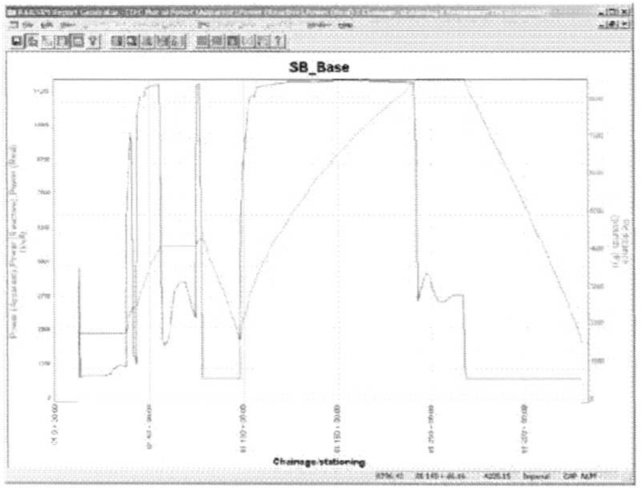
Figura 9. Muestra del manual RAILSIM y folleto abierto



Train Performance Calculator

RAILSIM® Train Performance Calculator (TPC) accurately and easily simulates a single train on a single track and is most useful for:

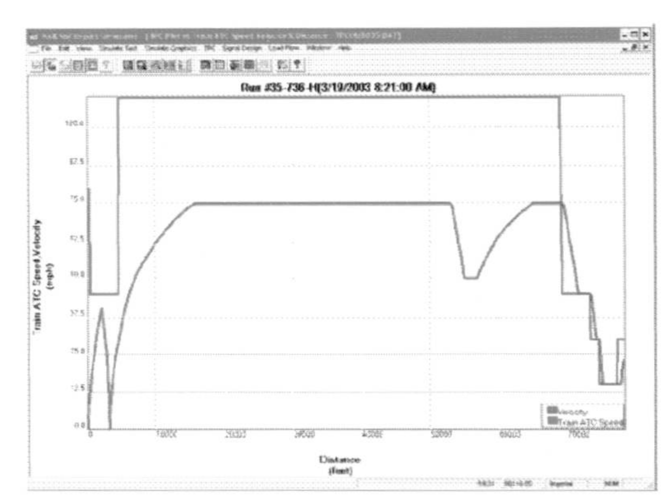
- Rail Network Planning
- Rolling Stock Design/Evaluation



Train Plot showing real, reactive, and apparent power components versus location

Capabilities

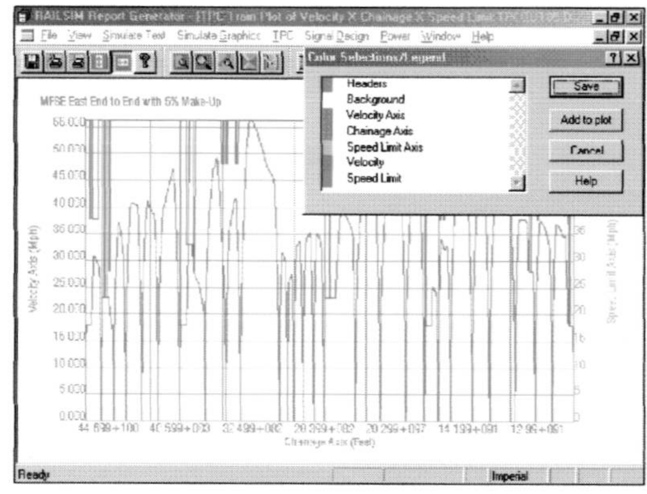
- Calculate curve speed limits where engineering calculations are not available.
- Analyze skip-stop operations, alternative stopping patterns, and the impacts of global or station-specific dwell time improvements.
- Calculate peak power and energy consumption to evaluate energy savings from coasting strategies and more energy-efficient rolling stock.
- Compare the performance and trip times of different rolling stock models, including off-the-shelf and custom-built models.
- Determine power to weight ratios under a variety of adhesion conditions where severe grades and curves are an issue.
- Evaluate trip time adjustments when low adhesion conditions prevail.



This TPC Train Plot shows speed and velocity versus location.

Features Summary

- 8 run types
- Complete user control of the run parameters allow for fast and easy changes for each simulated train run (calculation timestep, schedule margins, .train loads, tractive/braking force curves, jerk rate limiting, etc.)
- Real-world rolling stock model data (or create your own) for precise train composition-specific analysis

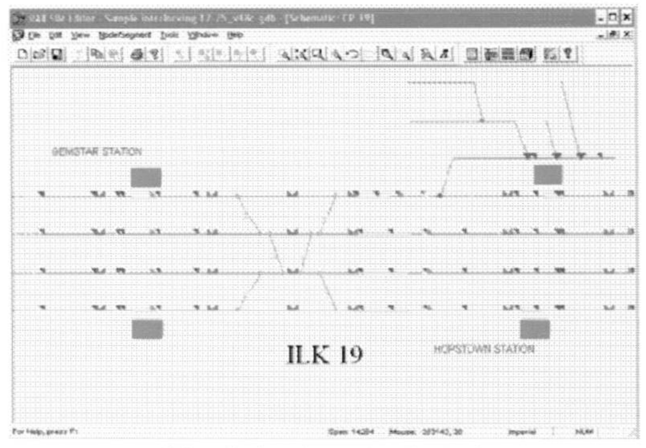


TPC accurately models resistance against train movement, including the effects of flange, journal and bearing resistance, aerodynamic resistance in open air and tunnel environments, grade effects, and curve effects.

SYS TRA RAILSIM

RAILSIM Editor

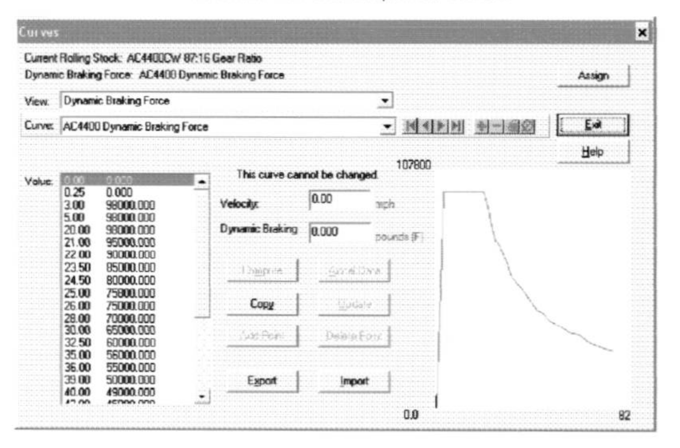
RAILSIM Editor is the single-source, user-friendly tool for defining rail network simulation models including infrastructure, control systems, equipment, and operations.



Schematic view of a complex rail network

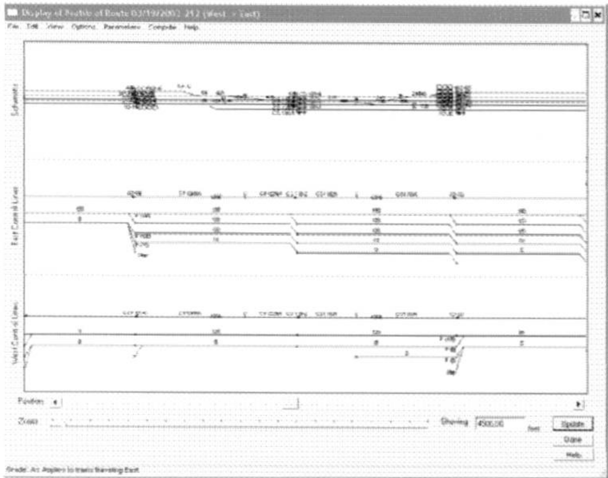
Capabilities

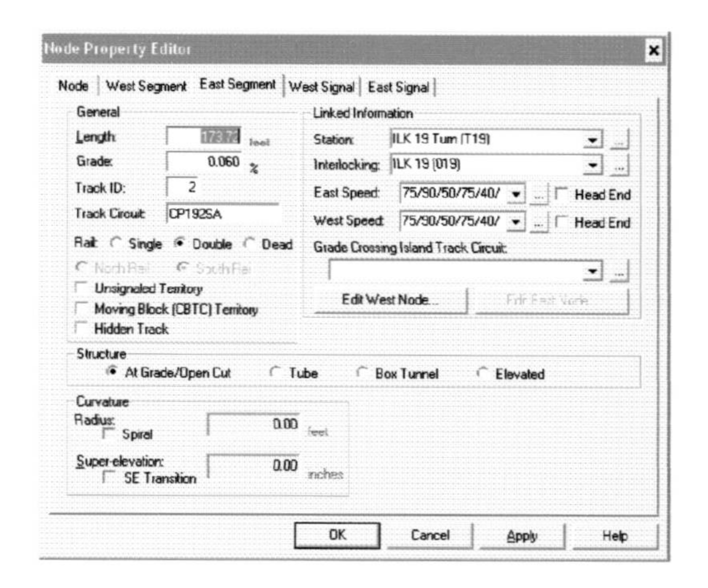
- Model any rail network from the simplest to the most complex multi-line, multi-modal network.
- Store all departments' engineering data in a single repository
- Define multiple operating plans within a single model
- Specify train routes interactively
- Define schedule patterns and subsequent associations with individual trains or train classes.
- Replicate specific train trips at specified intervals.
- Assemble train consists from RAILSIM Rolling Stock Libraries and/or user-defined models, complete with user-defined or computed performance curves.
- User-defined signal aspects/operating rules
- Wayside/no cab, wayside/cab, cab/no wayside and Communications-Based Train Control (CBTC)
- Mixture of cab signal equipped and non-equipped vehicles operating on the same system
- Track warrant/manual block systems



Track Profile Editor

- Isolate train routes to edit/analyze
- Define purpose-specific engineering drawings for export to CAD-compatible files
- Access the RAILSIM Headway, Safe Braking Distance and Control Line Calculators







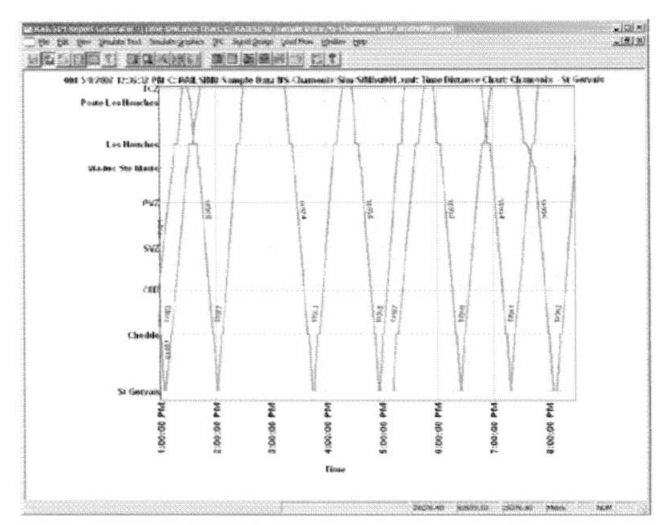
Network Simulator

Utilize detailed and site-specific diagnostic reports to calibrate the simulation model to real-world, field-measured acceleration and braking rates, terminal-to-terminal run times, observed signal code restoration clearing times, and run time impacts resulting from diverging routes.

Output

Using Report Generator, many graphical and text reports can be created, including:

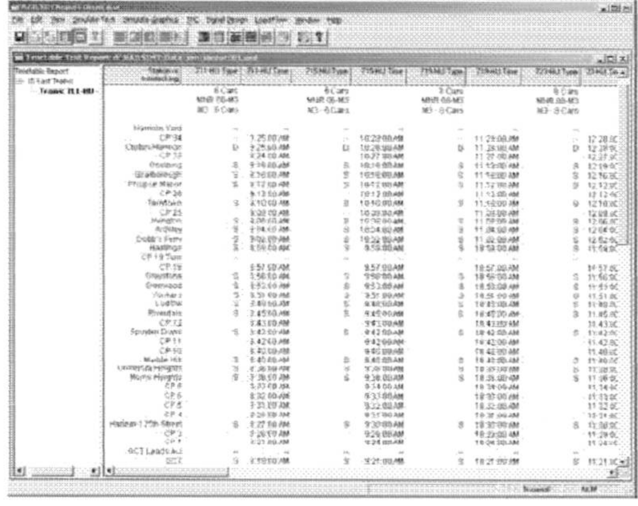
- Delay Analysis Report
- Delay Summary Report
- Failures and Operating Events Report
- Interlocking Report
- Lateness Report
- Passsenger Flow Report
- Passenger Statistics Report
- Passenger Loading Report
- Signal Clear Report
- Signal Delay Report
- Station Report
- System Lateness Report
- Timetable Report
- Track Use Report
- Train Report
- Train Detail Report
- Time-Distance Plot (String Chart)
- Graphic Passenger Flow Report
- Graphic Passenger Loading Report
- Graphic Station Report
- Graphic Train Report



Sample Graphic Time-Distance Plot (String Chart)

Train ID Inbnd	Train ID Outbd	Event Type	Track Number	Previous Train(s)	Scheduled Time	Simulated Time	Time Difference
	1365-NH	No Stop	4			3:12:21 PM	
	1567-NH	No Stop	4			3:21:20 PM	
1340-NH		No Stop	3			3:28:42 PM	
	564-HA	Arrival	4		3:31:00 PM	3:32:27 PM	-0:01:27
	564-HA	Scheduled Depart	4		3:31:25 PM	3:32:52 PM	-0:01:27
	1367-NH	No Stop	4			3:45:21 PM	
549-HA		Arrival	3		3:43:00 PM	3:45:50 PM	-0:02:50
549-HA		Scheduled Depart	3		3:43:25 PM	3:46:15 PM	-0:02:50

An excerpt of a typical text format Station Report



The Timetable Report generates schedule data in a publishable format. Options are included for train consist, train class, previous equipment trains and previous crew trains.



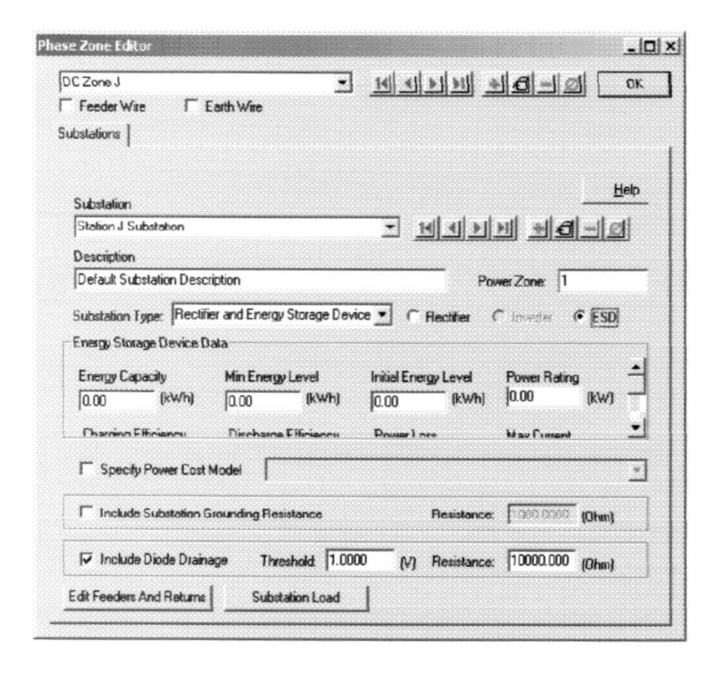
Load Flow Analyzer – DC

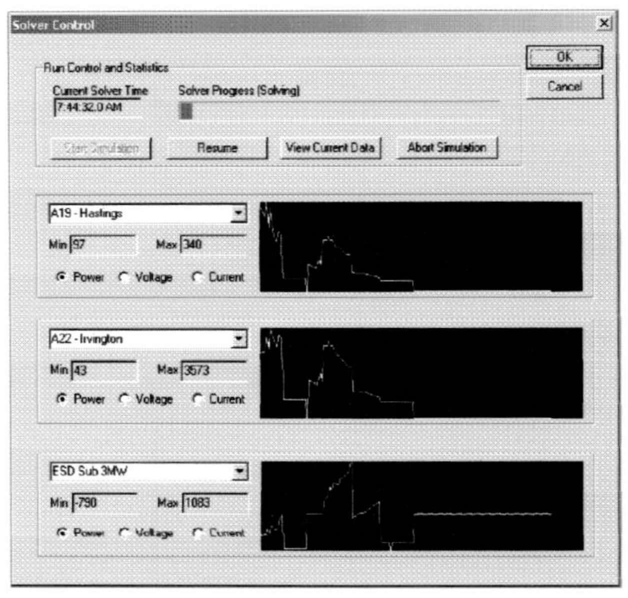
Load Flow Analyzer – DC is used for comprehensive and flexible modeling of any direct current (DC) electical network and analyzes:

- System Electical Capacities
- Power Demand
- Power Costs
- Effects of Regenerative Braking

Capabilities

- Support for rail networks of any complexity
- Mixed fleet operations
- Deterministic (non-variable) and stochastic (variable) train operation/headways
- Headway-based inputs with identical train types
- Unlimited train types, train lengths and schedules
- Zone-specific power, energy and cost analysis
- Overall and train-specific regenerated power receptivity analysis
- Train Volume Monitoring by Location





RAILSIM LFA lets you graphically monitor up to 3 independent locations and variables during the solution process.

Summary of Features

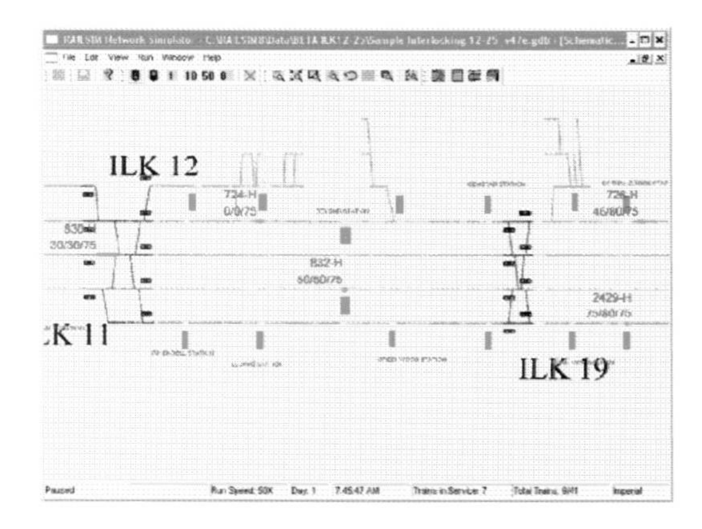
- Rail to earth leakage
- Location-specific single rail return for traction current
- Static loads (including import capability for load profiles that vary by time of day)
- Varying overhead conductors (trolley wires and contact wires) in different sections
- Different sizes of running and third rail sections
- Cross track connections between running rails
- Conductor gaps (bridgeable or unbridgeable by the train) in overhead or running rails
- Overhead trolley wire isolation switch status (on or off at given time duration)
- Substation outages for specified time durations
- Positive / negative feeder outages
- Connections between different tracks (jumper wires)
- Positive and Negative Feeder Conductor Locations
- Track Circuit Section Boundaries (Supply Conductor Gaps)
- Overhead Line/Track Resistance Change Points
- Generic Load and Resistance Point Locations



Network Simulator

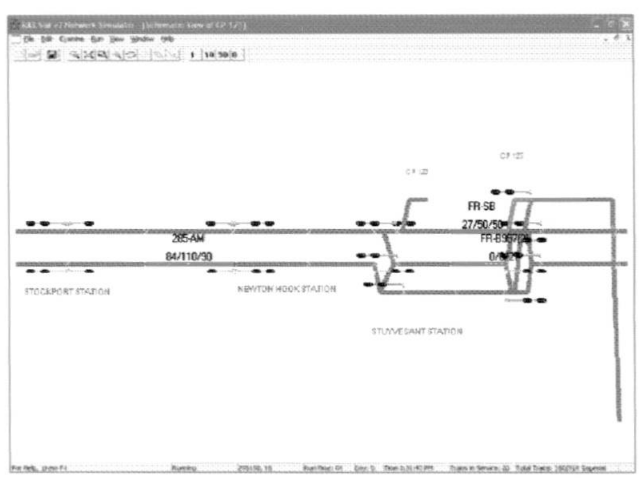
RAILSIM Network Simulator is models train operations on virtually any train control system over a virtually-unlimited rail network of multiple corridors and multiple modes. RAILSIM 'NS' is most useful for:

- Rail Network Planning
- Capital Improvements Planning
- Timetable and Operating Plan Validation
- Line Capacity Analysis
- Signal Design Validation



Capabilities

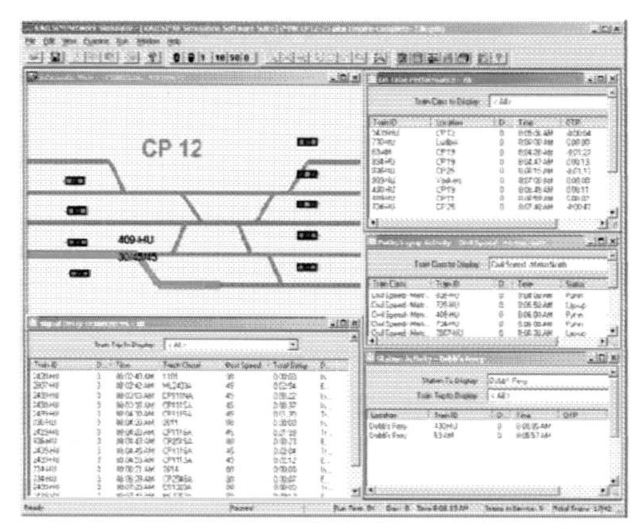
- Evaluate critical capacity limitations due to signal block spacing and solutions for eliminating these constraints.
- Test new train control systems or retrofits.
- Verify capacity requirements for line extensions and new designs.
- Evaluate infrastructure changes (upgraded track speeds, reconfigured interlockings, modified yard configurations, line extensions, double tracking, and new terminals).
- Test operational alternatives and their potential sensitivity to minor perturbations as well as completely different operating strategies in routings, direction of traffic, terminal manipulations, and station stops.
- Analyze line capacity given the operating contraints of multiple train classes, stopping patterns, signal systems, and dispatching strategies, identify bottleneck locations, and test alternative solutions.



RAILSIM Network Simulator simulates complex interactions between passenger and freight operations for existing and emerging high-speed corridors

Features Summary

- Automatic conflict detection and resolution
- 'Optimizer' to diagnose model issues
- Cab and wayside signaling (and wayside with cab)
- Advanced interlocking processing
- Operational randomization (dwell times, train put-in times, and tractive effort)



RAILSIM Network Simulator supports multiple run-time windows — geographic views, schematic views, and many types of text windows — all dynamically updated as the simulation progresses.



- Track (Supply Conductor) Isolation Switches
- Track Leakage Resistance Change Points
- Supply/Return Jumpers
- Energy storage devices, such as flywheels and storage batteries, and substation diode drainage
- Substation Loads
- Power Cost Models (with Peak Power tarif charges of three types: Instantaneous, Fixed Interval, Sliding Interval)

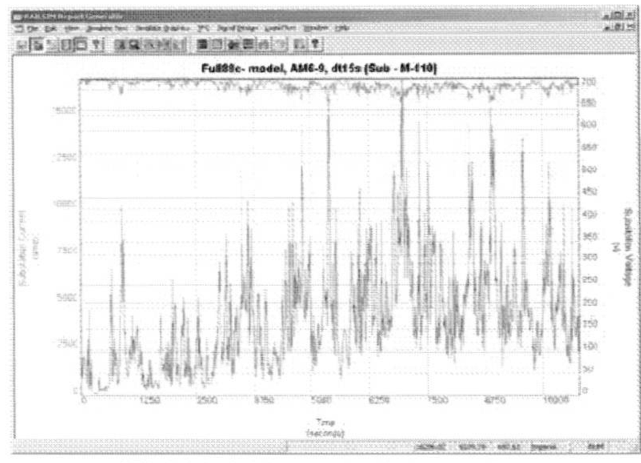
Output

Text and graphical output is easily generated in RAILSIM Report Generator. The Load Flow Text Report Wizard supports the simultaneous specification of detailed and summary reports, including:

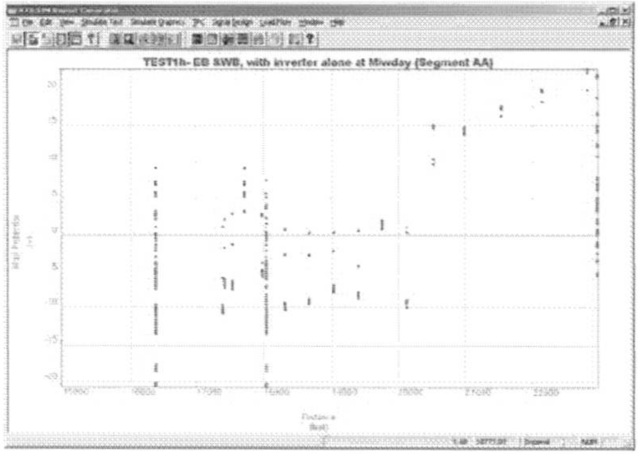
- Train reports with time and distance-based electrical demand
- Voltage at train pantograph or third rail shoe
- Substation loads and voltages
- System electricity costs predictions, including energy consumption and a variety of demand-based rate structures

The Load Flow Plot Wizard permits simultaneous specification of up to 11 different plots per selected analysis. Typical output includes:

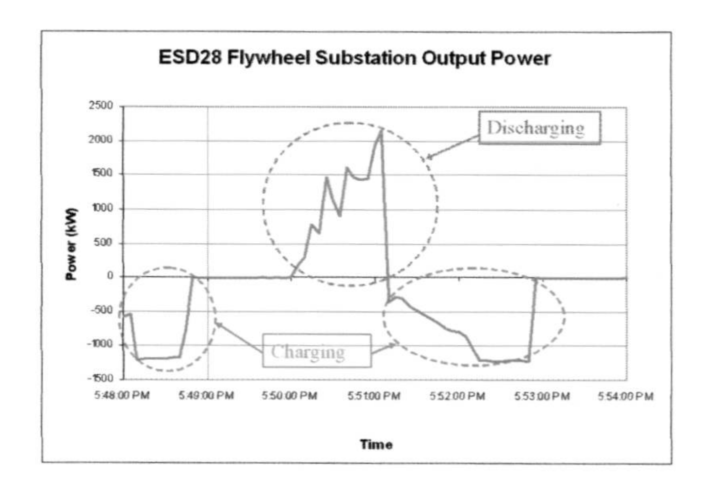
- Detailed train reports with time and distance-based electrical demand
- Voltage and current at train pantograph or third rail shoe
- Substation loads and voltages
- Time over current ("current limit") reports that highlight potential breaker trip occurrences
- Low voltage report highlighting all occurrences of trains experiencing less than desired voltage at the third rail shoe or pantograph
- Prediction of system electricity costs, including energy consumption and a variety of demand-based rate structures (which can vary within the simlated territory by substation utility feed)



LFA plot of substation current and voltage over time.



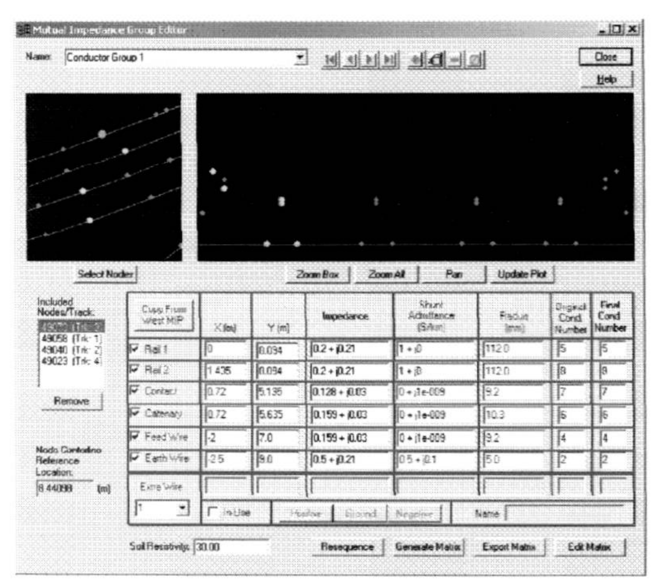
LFA scatter plot of rail potential over distance.





Load Flow Analyzer – AC

Load Flow Analyzer – AC (LFA-AC) expands the capabilites of LFA-DC to include Alternating Curent (AC) system analysis.



RAILSIM LFA supports detailed modeling of mutual impedances through the Mutual Impedance Group Editor shown here.

Capabilities

LFA AC supports the definition of:

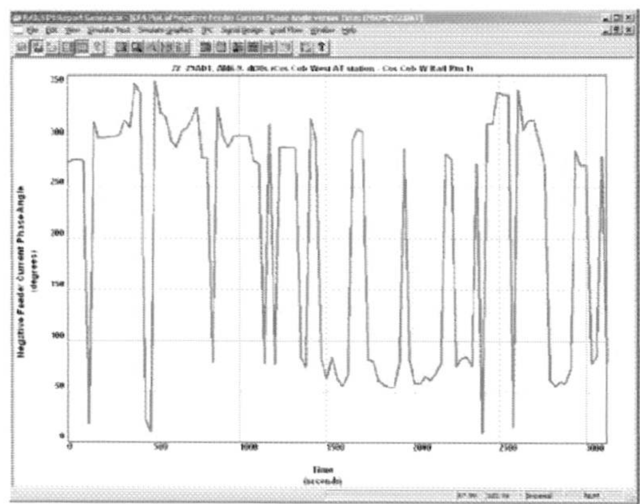
- AC substations
- Autotransformers
- Booster Transformers
- Capacitors
- Mutual Impedances at user-controlled intervals, using a graphical cross-sectional diagram.

AC LFA uses unconstrained power demand profiles for each simulated train from RAILSIM TPC. These power demand profiles reflect user specification of:

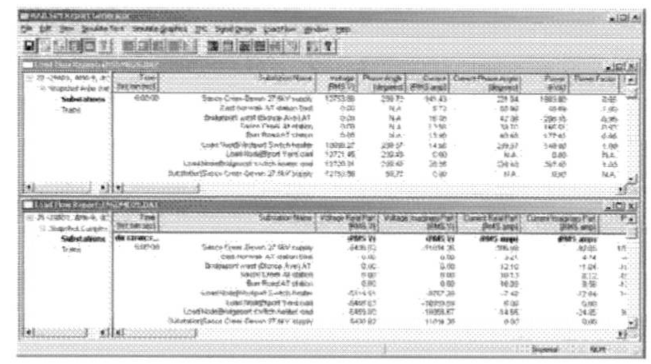
- AC substations
- Power Factor Curves, detailing real versus reactive power demand as a function of train velocity, and
- Power Factor for Auxiliary kW Load, specified individually for each locomotive, multiple unit car or passenger coach in the train.
- Different size of overhead conductors (trolley wires and contact wires) in different sections
- Different sizes of running rails (different size/composition of third rail sections) in different sections
- Power, energy and cost analysis for each power zone that supplies a group of traction substations
- Receptivity of regenerated power (for each train simulated and for the overall system)
- Energy saving due to regenerative braking (for each train simulated and for the overall system)

Output

LFA-AC analysis reports are generated via the same text report and plot wizards used for DC reports. The added information required for AC analysis interpretation is automatically included.



Negative Feeder Currents plot of current phase angle over time.



The LFA System Snapshot, in polar and complex formats, for an AC



Ing. Celso A. Spencer T.

has successfully completed training and is hereby a certified user of the following RAILSIM v8.1 modules:

Train Performance Calculator
Headway Calculator
Control Line Generator

RAILSIM Editor
Safe Braking Calculator
DC Load Flow Analyzer

July 22, 2011

Carol Steingress
Manager - Software Testing and Support

Gordon Yu
Senior Traction Power Designer

Karol E. Hammer
RAILSIM Product Manager



DRA. ARANZAZU BERBEY ÁLVAREZ

has successfully completed training and is hereby a certified user of the following RAILSIM v8.1 modules:

Train Performance Calculator
Headway Calculator
Control Line Generator
RAILSIM Editor
Safe Braking Calculator
DC Load Flow Analyzer

July 22, 2011

Carol Steingress
Manager - Software Testing and Support

Gordon Yu
Senior Traction Power Designer

Karol E. Hammer
RAILSIM Product Manager



DR. RONY J. CABALLERO

has successfully completed training and is hereby a certified user of the following RAILSIM v8.1 modules:

Train Performance Calculator
Headway Calculator
Control Line Generator

RAILSIM Editor
Safe Braking Calculator
DC Load Flow Analyzer

July 22, 2011

Carol Steingress
Manager - Software Testing and Support

Gordon Yu
Senior Traction Power Designer

Karol E. Hammer
RAILSIM Product Manager